Analyzing Children's Thinking about Sampling

The following item appeared on the 2013 National Assessment of Educational Progress (NAEP):

Richard wants to estimate the average (mean) monthly temperature of the United States last year. He will choose one of the following two methods to do this.

Method I: Richard selects his state and 9 other states that are near his state. Then he finds the average (mean) monthly temperature of each of those 10 states and uses those numbers to compute the average monthly temperature of the United States.

Method II: Richard selects 10 different states by writing the names of all 50 states on cards, with one state's name on each card. Then he places all of the cards in a hat and takes out 10 cards without looking. Finally, he finds the average (mean) monthly temperature of each of those 10 states and uses those numbers to compute the average monthly temperature of the United States.

Which method is better, I or II? Explain why.

Here are some children's responses to the NAEP item:

Student 1

Method II is better because the states he chose were random. In the first method all the states he chose were in the same region so they were have the same climate.

Student 2

Method II is better because instead of states in just one area being chosen, any state can be chosen.

method II is better because if he chooses all the states around him then they will all have relatively the same temp.

Student 4

Which method is better, I or II?

Method I

Explain why.

Because method I uses a sure way to find out the mean while method II is not

Source: Eighth-grade NAEP test item, block: 2013-8M6, number 13 (NAEP 2013); National Assessment of Educational Progress

After reading each student response presented above, do the following:

1. Organize the responses from "most developed" to "least developed." You can use as many categories to organize the responses as you wish. Explain why you categorized the students' responses in the manner you chose.

2. Describe the steps you would take to further support each student's learning.